CATCH THE RAIN WHERE IT FALLS

Improved planning and management of physical infrastructure & services for development in low & middle-income countries needs to focus on the basic needs & demands of the poor – Water

Small Tank Cascade Systems-Interlinking & Rehabilitation

Sri. A. Venkateswara Rao, Superintending Engineer (Retd.)
• **Encroachment of water bodies led to flooding: HC**
  Staff Reporter CHENNAI, November 28, 2015

• **Remove encroachments from water bodies: MDMK**
  COIMBATORE, December 18, 2015

• **Encroachment of tanks a serious threat** DECCAN CHRONICLE | SNV SUDHIR Published Dec 8, 2015, 11:57 am IST Updated Jan 10, 2016, 8:38 am IST

• **HC asks Gujarat authorities to fence water bodies**
  Times of India
Land & Water Resources of India

- Share of total World’s Resources:
  - Land 2.4%
  - Water 4.0%
  - Population 16%
  - Live stock 15%
- Projected population (2050) 1640 Million
- Current production of food 200 Million tons
- Projected Food grain reqt. 450 Million tons
- How to meet the Projected Food grain reqts?

Per Capita Water Availability (2001) 1816 Cubic Meter
Per Capita Water Availability (2011) 1544 Cubic Meter
## Water Resources Availability & Demand

Utilisable water resource of India is:

- **Surface runoff**: 690 billion Cum
- **Ground Water**: 433 billion Cum
- **Total**: 1123 billion Cum

### Water Resources Demand

<table>
<thead>
<tr>
<th>Scenarios</th>
<th>Year 2010</th>
<th>Year 2025</th>
<th>Year 2050</th>
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<td>Low</td>
<td>489</td>
<td>619</td>
<td>830</td>
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<tr>
<td>Medium</td>
<td>536</td>
<td>688</td>
<td>1008</td>
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<tr>
<td>High</td>
<td>556</td>
<td>734</td>
<td>1191</td>
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</table>

(Billion Cubic Meters: BCM)
Challenges

• Improvement in Irrigation efficiency.
• More crop & income per Drop of Water.

Means: Improved Performance from Water resource Projects.

Creating more storage Capacity.

- Water Storage Capacity of India - 253 (+51) Cum per person
- China - 2200 Cum per person
- USA - 6000 Cum per person

Total (Major & Medium + Minor)

<table>
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<tr>
<th>Category</th>
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<td>Created (Upto 2009-10)</td>
<td>107.2</td>
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<tr>
<td>Utilised (Upto 2009-10)</td>
<td>86.9</td>
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</table>
Water and climate change

• The hydrological cycle is predicted to be more intense, with higher annual average rainfall as well increased drought.

• Predicted increase in extreme rainfall and rainfall intensity.

• The Godavari basin is projected to have higher precipitation than Krishna & Ganga.

• Changes in the number of rainy days increases over most parts of the Godavari and Krishna basins.

• Water scarcity may also become more prevalent.
Changes in Annual Number of Rainy Days

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<tr>
<th></th>
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<tbody>
<tr>
<td></td>
<td>Annual Rainfall (cm)</td>
<td>Annual Flow (km³)</td>
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<tr>
<td>Krishna</td>
<td>91</td>
<td>60</td>
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<td>Godavari</td>
<td>166</td>
<td>98</td>
</tr>
<tr>
<td>Ganga</td>
<td>134</td>
<td>482</td>
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</tbody>
</table>

PRECIS Rainy days Change 2080s A2 - Baseline

Map showing changes in annual number of rainy days in different river basins in India.
Policy implications

Changes in precipitation pattern may affect:

- Planning and design of hydrological structures.
- River basin management, flood control and drought management.
- Agricultural policy: Require more flexible crop selection policies.
- Urban planning and industrial development.
- Forest policy to account for erosion mitigation.
- Planning will need to address overflow and capacity issues.
- Development of water-intensive industries need to consider siting issues.
Climate Change Vis a Vis Storages

• Climate change would affect the effectiveness of irrigation methods.

• Predicted increased variability in precipitation (longer drought periods), would lead to increased irrigation requirements.

• To conserve flood waters by way of storages is going to be most important in future.
Types of Tank

- Three types of tanks are normally referred
  - 1. Spring tanks
  - 2. Very deep tanks
  - 3. Ponds in the jungle
  - 4. Large tanks

Jungle tanks for wild creatures
Mountian tanks for chena (shifting) cultivation.
Slope tanks for soil erosion controlling.
Village tanks for human settlements & use
Tanks as Ecosystems

• The second largest manmade wetland Ecosystem in the world.
• Centuries of Service and a History : Beyond concept of sustainability . Still functioning and thriving.
• Used by Humans, Plants, animals and other species for economic value.
• Used for irrigation , freshwater fishing, washing, bathing and replenishing the flora and fauna that surround it including GWR.
• Life line of the village economies and human well-being.

There are about 208,000 tanks in India, and 120,000 are found in southern peninsula (Andhra Pradesh, Telangana Karnataka Tamil Nadu and Pondicherry).

Andhra Pradesh is the largest state of tank irrigation
About 727 000 hectares are irrigated by tanks.
About 28.8 per cent of tank irrigated area of India.
About 16 per cent of the total irrigated area by tanks.
Ecological implications of Tank Cascade Systems

- TCSs makes up interwoven irrigation network.
- Tanks, paddy fields, watersheds and canals are integrated with the natural environment.
- Natural wetland ecosystems other than rivers in the dry zone.
Irrigation Tanks in India

Earthen bunded small water harvesting structures formed in natural depressions of land to catch and store surface run-off during intensive spells of monsoon rainfall are known as “tanks” in South India.

Indigenously formed by native rulers & Chieftains over the past several centuries
Distribution of Tanks in India
# Comparison of Irrigated Area from different Sources AP

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<th>Year</th>
<th>Tanks</th>
<th>Per cent</th>
<th>Canals</th>
<th>Per cent</th>
<th>Other Wells</th>
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<td>35.71</td>
<td>2545000</td>
<td>49.99</td>
<td>17800</td>
<td>3.50</td>
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</table>
Reason for decline to tank irrigation

1. Decrease in inflows to the tank due to
   i. Inadequate rainfall
   ii. Upstream abstractions
   iii. Poor condition of feeder

2. Deterioration of physical system
   i. Breach in bund
   ii. Poor condition of the bund with unstable side slopes
   iii. Improper condition of surplus system needing repairs to the masonry structures
   iv. Defunct or inadequate functioning of sluice
   v. Decrease in the storage of the tank due to silting, encroachments

3. Poor canal system

4. Poor water use efficiency due
   i. Mono cropping of water intensive crop like paddy
   ii. Improper distribution and scheduling of water

5. Institutional deficiencies
Present status of Tanks – The Problems

a. Inadequate attention paid by the Govt. due to wider geographical distribution of tanks and poor allocation of funds.

b. Decline in tank-fed agriculture caused by

• Siltation, heavy weed infestation and encroachments in the tank bed and supply channel resulting in poor storage.

• Dilapidated bund, sluices and weir.

• Delinking of tanks in the ‘cascade’ due to encroachment in link channels.

• Extinction of some tanks due to urbanization.
Present status of Tanks

1. Permanent structure constructed within the tank.
2. Growth of Babul and other thorny trees.
3. Human encroachment, cultivation can be observed.
4. Tank spillway and silted area.
**Origin of Cascade System**

1. Early settlers in river valleys, first used water directly drawn from the streams.
2. Later, they made small tanks, ponds in valley bottoms.
3. Streams were dammed and water conveyed through canals to tanks.
4. When they realized that water is a seasonal resource they constructed tanks damming across rivers.
5. When paddy was grown a civilization based on triple elements called tank+ village + temple developed.
6. Ancient king’s main task was building of tanks and temples, considering it as a meritarious task.
7. Awareness on the topography helped build tanks at every possible sites.
<table>
<thead>
<tr>
<th>Period</th>
<th>Event Description</th>
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<tbody>
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<td>973-1184 A.D</td>
<td>Kalyana Chalukya took up vigorous tank bunding activities</td>
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<tr>
<td>1068-76 A.D.</td>
<td>Someswara I constructed several tanks in Dharwar, Bijapur &amp; Bellary district</td>
</tr>
<tr>
<td>1080 A.D.</td>
<td>Vikramaditya constructed a number of tanks &amp; repaired a breach tank of Tambasamudra</td>
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<td>1108-52 A.D.</td>
<td>Hoysala kings promoted construction of tanks</td>
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<td>13th Century</td>
<td>Yadavs’ built many tanks</td>
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<td><strong>Post Golden Age of Tank Irrigation</strong></td>
<td></td>
</tr>
<tr>
<td>1336-1565 A.D.</td>
<td>Biggest milestone of Vijaynagar Empire was Kaveri delta project Suekere tank</td>
</tr>
<tr>
<td>14th Century</td>
<td>Several tanks, reservoirs and canals were constructed</td>
</tr>
<tr>
<td>15th Century</td>
<td>Renovation &amp; maintenance of tank through co-operation &amp; contribution of people</td>
</tr>
<tr>
<td>16-18th Century</td>
<td>Period of prosperity &amp; great boom of activities in water works</td>
</tr>
<tr>
<td>1638-1799</td>
<td>Hyder Ali &amp; Tipu Sultan fought several wars and destroyed the time earned system of water harvesting</td>
</tr>
<tr>
<td>Pre-Independence</td>
<td>Decline of tanks was set in permanently during the British period</td>
</tr>
<tr>
<td>Post Independence</td>
<td>The government emphasised on construction of dam, promoted tube well ignored traditional water harvesting</td>
</tr>
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</table>
Why develop Tank Cascade Systems?

- Temporal and spatial disparities in annual rainfall.
- Soil moisture deficit during long dry spells and short rainy season.
- Recurrent droughts and desiccating winds while the seasonal flooding dominates the rainy season.
- Low water retention capacity of the soil.
- Deeper groundwater table.
- TCS to control seasonal flooding and droughts.
- Ensure cultivation during both rainy and dry seasons.
- Provide water supply for domestic and livestock consumption.
- Undulating topography is well suited for the construction of reservoirs.
Evolution of the Cascading System

- Most jungle tanks were destroyed by outside invaders by the 11th century.
- During (1650-1796) attempts were made to restore canal aniciuits irrigation systems, but tanks in the dry zone were neglected.
- British period the tank irrigation system was poor. They made effort on restoration and repairing of tanks but used an approach of selecting individual tanks rather than the whole cascade system.
- During post-independence special attention on the building of large scale river projects. Small tank systems were further neglected.
- After 1970s, National attention was focused on the Diversion Scheme. Small tanks were neglected and even some small village tanks were physically damaged/occupied.
Cascade System of tanks

Cascade is a "connected series of tanks organized within the micro-catchments- tanks in a cascade are hydrologically interlinked. Storing, conveying and utilizing water from ephemeral rivulet.

Adherence to:
(a) having an adequate volume of water in every tank in a cascading valley even in a year of below-average rainfall;
(b) Instituting a regulated flow of water from one tank to another downstream,
(C) Avoiding a sudden influx of large volumes of water to minimize the risk to tank bund breaching."

Over 80% of the small tanks are as cascading systems within micro and meso-catchments in the Dry undulating landscape.
Tank Cascading System

- A Cascade is a chain of tanks connected by water, flows from one to another, located in the downstream within the meso-catchment

- Means of storing, conveying, distributing and utilizing water from first or second order streams

- A small storage reservoir system with hydrologic interlinkage.
- Irrigation tanks, interconnected forming cascades allowing surplus flow from the upstream tanks(s) and return flow from the upstream command area, to reach the tank that is immediately downstream.
Factors which govern the distribution patterns and densities of the STC Systems are:

1. Amount of annual and seasonal rainfall.
2. Geomorphology of the landscape—landform type.
3. Nature of the underlying lithology and soil overburden.
Typical tank cascade

Fig. 3. Schematic representation of a tank cascade.
Scattered and randomly distributed Tanks and Paddy fields in a Dry Zone catchment.
Typical Cascade System

- Upper course
- Small tanks
- Middle tanks
- Big tank
- Watershed boundary
- Micro-catchment area
- River/canal
- Tank
- Paddy field
- Settlement

Lower course
Attributes of Tank Cascade

• A tank cascade is a series of tanks connected together within the catchment.
• The configuration of physical system of tank cascade is considered as a node-link system of configuration that can delineate relative positions of tanks & their interconnections.
• The nodes indicate tanks and the links indicate the interconnection between tanks without any physical link. Each tank is assigned a node number and tank type depending on its relative Position.
• Start tank (ST - a tank with no inflow from upstream tanks)
• Normal tank (NT- a tank with inflow from one upstream tank)
• Confluence tank (CT- a tank with inflow from more than one upstream tank).
Village Tanks to Cascades

- 1 Start tank (ST - a tank with no inflow from upstream tanks)
- 2 Normal tank (NT- a tank with inflow from one upstream tank)
- 3 Confluence tank (CT- a tank with inflow from more than one upstream tank).
Irrigation Tanks in cascades

Satellite image
Cascade Systems-Importance

Significance of Cascade Systems as traditional Irrigation Technology which addresses:
• Droughts – chronic, recurrent and highly damaging in the areas concerned
• Flash floods - during episodes of unusually heavy rainfall. By creating efficient storage systems peak flows can be reduced up to 55%
• Land degradation – controlling siltation of reservoirs systems
Linear and branched Cascades
Objectives of Tank Cascade System

• Efficient use of water Resources in an Integrated resource management.
• To sustain tank fed agriculture and enhance productivity
• To bring back people managed tank governance.
• To build People Institutions for tank / pond management.
• To create endowment / corpus at multiple level to safeguard tank systems in future.
• To develop rational criteria for assessing resources, including groundwater of small tanks Cascades
• Implement holistic socio-technical approach to rehabilitation.
• Minimum dead storage of 1–1.5 ha is to be created in the tank bed to cater to the needs of fish culture and livestock. This will also serve to provide life irrigation to the standing crops.
Land use map in a Cascade System
Rehabilitation / Revival of Tanks-Concept

**Past**
- Use
  - Silted & Desilted by People

**Present**
- Silted
  - Encroached & disused
  - Use

**Future**
- Use
  - Encroach-men t eviction & Renovation
Objectives of RRR

• Increasing tank storage capacity.
• Ground Water Recharge.
• Increased availability of drinking water.
• Improvement in agriculture/horticulture productivity.
• Improvement of catchment areas of tank commands.
• Environmental benefits through improved water use efficiency; conjunctive use of surface and ground water.
• Community participation & contribution for sustainable management of water bodies.
• Capacity Building of communities, in better water management.
• Development of tourism, cultural activities etc.
Principles of Renovation of Water Bodies

• Sustainability through community participation and empowerment
• Create Enabling legal and institutional environment to implement the solutions emerging out of participatory and demand driven processes.
• To promote and enhance livelihood options.
• Community contribution made mandatory.
• Drought Proofing
• Flood Proofing
• Control Land degradation

Although the project benefits farmers more it includes other users too.
Drawbacks in Rehabilitation Schemes

- Tank rehabilitation and restoration implemented in the past were mostly limited to hardware aspects repair of structures.
- Lack of attention to cascade connections and to ecosystem.
- Developing individual tanks
- Negligence towards development of community infrastructure.
Need for Scientific approach

• Majority of small tanks are positioned as cascades.
• Increasing storage capacity of one or two tanks in the cascade or expanding command area or diverting water from the cascade would alter the cascade hydrology, unless there is excess water.
• Tank hydrology also influences groundwater storages.
• Alteration of catchment hydrology affects availability of groundwater.
• Scientific approach needed for cascade rehabilitation or restoration.
Criteria for tank selection

Individual water body within Cascade approach.
Minimum water spread area of 5 hectare in rural areas to 10 hectare in urban areas. (RRR)
• Presence of small and marginal cultivators in majority
• Scope for improvement based on tank hydrology
• Incidence of poverty (identification of poor families through wealth ranking)
• Good leadership and cohesiveness in the community
• Willing farmers to contribute a part of the project cost through labor and/or money,
• Willingness of the community to execute the works themselves maintain and manage the system thereafter
Frame work for Rehab. & Interlinking

1. Conduct a participatory rapid appraisal survey of land and water use identifying, particularly, CI of various tanks under a chosen cascade.

2. Characterize the tank cascade system based on topography, soil, geology, hydrology and land use with regard to potential for further development.

3. Characterize an Individual tank in a cascade by its potential for rehabilitation (hydrologic potential, technical potential and managerial potential).

4. Analyze surface water potential of the individual tanks under the cascade for improving CI through the Hydrologic Simulation Model.

5. Analyze groundwater situation of the sub-watershed and estimate the potential for agro-well development.

6. Carry out a technical survey and analysis for individual tanks to improve the physical aspects of tank inflow, tank storage capacity, and tank water distribution.

7. Conduct a SWOT analysis to identify management interventions to be introduced.

8. Carry out a benefit-cost analysis to prioritize tanks for tank rehabilitation.

9. Based on benefit-cost (B-C) ratio, pro-rata cost and economic internal rate of return (EIRR), select a tank for rehabilitation.

10. Carry out a detailed design for tank rehabilitation.
Data required

- Village background
- Hydrology of tank
- Components of tank
- Water balance of the Cascades
- Ayacut
- Groundwater status
- Socioeconomic background thro’ questionnaire survey
- Benefit/Cost.

Topographic Map 1:50,000
- Satellite Images
- Aerial Photographs
- Land Use Maps of cascades
- Field sketch maps
- Water quality investigations
- Engineering measurements
Hydrological data

- Surface water available to an individual tank of an STC are:
  - (i) Rainfall,
  - (ii) Runoff,
  - (iii) Drainage return flow and
  - (iv) Spill water from the upstream tank.
- A tank may receive supplementary diversions from another tank canal or a river

The higher the CA/WA ratio, the greater the hydrological potential.
Parameters for Tank Rehabilitation

- Khariff Cropping Intensity (CI).
- Ratio of Tank Catchment Area (CA) to Water Spread Area (WA), expressed as (CA/WA).
- Ratio of Command Area (COA) to Water Spread Area (WA), expressed as (COA/WA).
- Based on the above 4 categories are given for Rehabilitation
Types of Rehabilitation

Tank rehabilitation”
• Restoration of an *old, abandoned* tank with reclamation and development of the command area.
• Restoration of a "*non-working old tank*“ with limited cultivation due to the tank bund being breached or the lack of delivery system or both.
• Improvements to a *working tank* to increase its existing storage capacity or to expand its cultivated command area or both.
• Improvements include the raising of the bund/spill improving other components sluices and delivery system.
• Refurbishing an existing *working tank* with no modifications.
• Usually involves carrying out deferred maintenance and at times, strengthening of the bund and spillway.
Components of Rehabilitation

• Rehabilitation and Physical Improvement of Infrastructure Facilities
• Conservation and Management of Catchment and Related Environmental Components
• Community Mobilization and Capacity Building of Farmers and Farmer Organizations
• Capacity Building of Line Agencies
DPR – General Information

• Details of present status of the water bodies with reasons for deterioration

• Categorization in terms of location in (i) special category states, hilly states (ii) desert, drought prone, tribal and Naxal affected areas in non-special category states (iii) other areas not covered under category (i) and (ii).

• Rainfall last ten years, ground water level, land use pattern, soil characteristics, climate availability of water in the catchment area for water body, water quality situation in the water body and adjoining areas. No polluted effluent without treatment should fall in the water body.

• Original CCA, present CCA and CCA planned in the DPR

• Original storage capacity/present storage capacity and storage capacity planned
DPR- Scope of work

- De-silting in terms of quantum of silt to be removed, repair of conveyance system, strengthening of bund(s), repair of weirs and sluices, catchment treatment, command area development, soil erosion prevention works, quality control measures.
- Maps of catchment and command areas are to be enclosed in the DPR.
- Capacity building of implementing agencies sensitization of stakeholders
- Monitoring and evaluation
- Catchment area treatment works if started under Integrated Watershed Management Programme (IWMP) would be included in the scheme of RRR of water bodies.
DPR- Targeted benefits

- Creation of additional irrigation potential, Increase in agriculture / horticulture / pisciculture production
- Increase in recharge of ground water
- Improvement in water use efficiency
- Increase in availability of drinking water
- Impact on water quality
- Removal of weed growth
- Promotion of tourism, birds migration and culture.
- Work out Benefit Cost ratio (BC ratio) for each water body.
- Benefit Cost ratio (BC ratio) has to be minimum 1:1 Special Category States, undivided KBK districts of Orissa, in drought prone, tribal and naxal-affected areas
- In other areas 1.5:1.
DPR-Implementation schedule

- The Institutional structure proposed
- Water Users’ Association (WUA) at the Gram Panchayat Level
- Arrangements at District Level DLIA
- A State Level Nodal Agency (SLNA)
- Technical Advisory Committee (TAC) TAC shall also include representative from Central Water Commission (CWC) and Central Ground Water Board (CGWB).
Monitoring & Evaluation

• Regular monitoring of the project is to be carried out at each stage.
• Monitoring would include maintaining of both physical and financial
• Baseline survey would be conducted before the commencement of the project execution. Evaluation and impact assessment of the scheme will be done by independent agencies
• Monitor the quality of works as per the relevant BIS codes
• Impact assessment can be done after completion of the scheme
Check List for preparation of DPRs

• Whether census of water bodies completed and assigned unique code number?
• Whether water bodies having minimum water spread area of 5 hectare in rural areas and water spread area of 2-10 hectare in urban areas are included?
• Are private water bodies included in the DPR?
• Whether WUAs & Panchayats have been associated for selection of water bodies and capacity building?
• Whether water bodies are included in the district plan?
• Whether rain fall data for last 10 years, ground water level, land use pattern, water quality situation in the water bodies and adjoining areas have been included?
  Whether details of original CCA / present CCA / CCA expected after rejuvenation have been included?
• Whether details of original storage capacity/present storage capacity and storage capacity expected after rejuvenation have been included?
Check List for preparation of DPRs

• Whether maps of catchment and command are enclosed?
• Whether latest SOR adopted for preparation of cost estimates?
• Number of people benefitted
• Number of farmers of SC/ST community benefitted
• Whether benefit cost ratio has been incorporated?
• Whether implementation schedule and corresponding requirement of funds, details of arrangements for monitoring and evaluation has been included?
• Whether convergence with IWMP or other schemes have been taken into account?
• Whether District Level Implementing Agency has been identified?
• Whether State Level Nodal Agency has been identified by the State government?
• Whether Technical Advisory Committee has been constituted with Members from CWC & CGWB
Check List for preparation of DPRs

• Whether objective of the proposals is mentioned?
• Whether details of present status of water bodies with reasons for deterioration & likely benefits (creation of additional potential, increase in agriculture) included?
• Whether the categorisation of Projects - Special Category/DP/DDP/TA/ DPA/ Naxal affected area or Non-Special Category is mentioned?
• Whether detailed Work Programme & corresponding Detailed Financial Programme attached?
• Whether detailed calculation of B.C Ratio using latest authenticated published data (Quantity and Rate of yield) from the Ministry of Agricultures, GoI has been considered?
• Whether detailed of Proposed Programme of Monitoring & Evaluation (both Physical & Financial Programme) is given?
Cascade System Evaluation

- Primary and secondary data to be gathered and analysed.
- Hydrological, ecological and socio-economic relationships of the cascading systems to be analysed.
- Baseline survey data collected from government departments NGOs and NGOs and research centres.
- Topographic sheets (Scale of 1:50,000) and Google Earth maps required to understand the spatial relationship of the cascade systems.
- Information on the rainfall to understand the pattern of rainfall in the district.
- The components like annual rainfall number of rainy days and dry spell (5 yrs) to be collected.
Parameters of a cascade

• Cropping intensity past five years.
• Tank locations within the cascade, i.e., whether at the top, middle or bottom or at the confluence of two side valleys with the main valley axis.
• Ratio of micro-watershed area to tank water spread area, ratio of command area to tank water spread area
• Reasons that the full command area does not get cultivated during a season of very good Khariff rainfall with full tank supply—whether it is technical or socioeconomic.
• Rainfall pattern and tank spill characteristics (duration, frequency and magnitude).
Hydrological attributes

Linear or slightly branched form with a form index of more than 1.5 (form index is the ratio of the overall area of the cascade to its overall length)

Gently sloping gradient of the main axis. (0-2.0 percent slope).

Amount of annual and seasonal rainfall.

Geomorphology of the landscape—landform type.

Nature of the underlying lithology and soil overburden
Performance indicators

• Estimate the status of tanks in all agro-climatic regions and irrigation districts for effective management

• Cascade water surplus indicator: Tank system irrigation water demand (It), tank storage capacity, St, cascade outflow Rc’, cascade outflow per unit area Re’, (It) is related to tank command area (Atco) purposes.

• Water surplus of cascade (WSe) = Re / R50

• Where Re is outflow per unit area R50 mean annual rainfall. If this ratio is greater than 5% then the cascade has surplus water that could be refined after field measurements. Ro/It > 1, indicate tank has adequate water to meet the needs of the people. St/It > 0.3, tank has the ability to hold 30% of the requirement.
BENEFITS FROM A COMPREHENSIVE TANK SYSTEM MANAGEMENT

- Benefits from a Healthy Tank System
  - Increased tree cover
  - Migration of birds stopped & immigration encouraged
  - Fisheries development
  - Sustained availability of water for drinking and agriculture
  - Effective Soil Conservation
  - Employment Generation
    - Crop yield doubled (2 assured crops a year)
    - Dairy development Improved nutrition (more food, more milk)
    - Cultural life improved
    - Increased green and dry and fodder
    - Fertility of the dry-lands improved
    - Ground water situation improves electricity will be saved
  - Food Security
# SWOT Analysis

<table>
<thead>
<tr>
<th>Factors</th>
<th>Strengths</th>
<th>Weaknesses</th>
<th>Opportunities</th>
<th>Threats</th>
</tr>
</thead>
</table>
| Physical                     | ▶ Rich inflow during Khariff  
▶ Sufficient tank capacity.  
▶ Good physical condition of head works.  
▶ Sufficient land area developed. | ▶ Local catchment inflow is disturbed by road network  
▶ Canal network is not adequate.  
▶ Existing Canal network is dilapidated. | ▶ Water availability in the tank.  
▶ Possibility of improving canal system.  
▶ Allow local catchment inflow by changing a few critical culverts that disturb the inflow to the tank. | ▶ Catchment area chena cultivation.  
▶ Tank bed cultivation. |
| Social (institutional and managerial) | ▶ Community is homogeneous.  
▶ Residences are located close to the command area.  
▶ Most of the people in the village own land  
▶ Fertile land (no salinity or any other problems ). | ▶ Farmers are not organized into groups  
▶ A powerful group of farmers own land in existing command  
▶ Lack of agri-extension facilities  
▶ There is no system for water management  
▶ Delay in land preparation  
▶ Low interest of group of farmers in cultivation in Rabi  
▶ Low yield | ▶ Potential for organizing farmers  
▶ Potential for motivating farmers to cultivate new areas under command  
▶ Potential for improving water management practices  
▶ Potential for bringing farmers to do timely cultivation.  
▶ Potential for increasing yield | ▶ Domination of one community farmers in water use.  
▶ Farmers priority for chena  
▶ Further fragmentation of land |
Model for Small Irrigation tank Rehabilitation

**Tank selection & planning of rehabilitation**
1. Approval through DAC
2. Verification of selection by field investigation
3. PRA and walk through survey
4. Decide the beneficiary and project construction
5. Prioritization of problem
6. Ratification
7. Display the beneficiary entitlement

**Mobilization of beneficiary farmers**
1. Systematic training and awareness programmes
2. Use of community knowledge and wisdom
3. Arrange continuous dialog with project and agency staff
4. Award construction contract to local FO’s providing necessary skills.

**Holistic and Integrated**

**System rehabilitation & livelihood enhancement**
- Support for off-farm activities
- Intervention for upland cultivation
- Land survey and demarcation of reservations
- Development of environmental Components
- Cascade based interventions

**Development Approach**

**Appropriate institutional arrangement**
1. Community based scheme level organization
2. Cascade management committee

**Mobilization of Agency staff**
1. Orientation on roles and responsibilities
2. Training and capacity building to change traditional mindset
3. Ensure participation in all stages of development
4. Make them involve in distribution of benefits

**Sustainable Irrigation Scheme**
1. Formation of O&M fund
2. Collection of salaries/O&M fee
3. Appointment of caretaker
4. Routing maintenance arrangement
5. Empowered FO
Local Management

- TA – Tank Association
- CA – Cascade Association
- TF – Tank Federation at block level

Diagram:
- Gram Panchayat
- Panchayat Union
- Gramasabha
- TA
- CA
- TF
Guide lines - Local Institutions

• Tank based watershed development should be encouraged. Guidelines could be revised to include all water bodies’ renovation and creation within the watershed.

• Pollution of water bodies should be treated as an offence and a criminal act.

• Ground water recharge is possible through such preservation and conservation of small ponds.

• Sand mining of waterways and riverbeds should be banned.
Strategies and empowerment.

• Involve the farmers in the project activities from initial step of planning
• Preparation of community action plan
• Contribution of labour for project work to cover not less than 10 percent of the total project cost
• Walk through survey to identify problems of the scheme
• Creating awareness and training programmes. (knowledge, skills and attitudes).
Constraints

Adoption of a cascade-based holistic approach to water management becomes difficult due to:

- Lack of a clear technical understanding of the hydrology, the physical characteristics of tank cascades and their interactions, influence on hydrological behavior.
- Absence of field-tested methodologies, tools criteria for evaluating the hydrological properties of cascades and identifying specific tank rehabilitation interventions based on cascade hydrological endowment.
- Non-adoption of a holistic approach of linking hydrological parameters with rehabilitation interventions and a farming-system approach with suitable Institutions.
Renovating, Rehabilitating and Interlinking of the small tank system without addressing issues ranging from cascade hydrology, to catchment conservation and downstream impacts, may even be more harmful, defeating the very purpose of the whole exercise.

THANK YOU